

BMJ Open Role of contextual and compositional characteristics of schools for health inequalities in childhood and adolescence: a scoping review

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ABSTRACT

Objectives To synthesise the evidence on the role of compositional or contextual characteristics of schools in the association between students' socioeconomic position and their health in primary and secondary education in developed economies.

Design Scoping review. We included studies examining the role of at least one school or class characteristic on students' health inequalities and was published since 1 January 2000, in English or German. We searched PubMed/Medline, Web of Science and Education Resources Information Center. We provided a narrative synthesis and an overview of findings. School characteristics were grouped into five broad categories: school composition, school climate, school policies and organisation, food environment and facilities.

Results Of 8520 records identified, 26 studies were included. Twelve studies found a moderating and 3 a mediating effect. The strongest evidence came from studies examining the moderating effect of school composition, that is, the negative impact of a low individual socioeconomic position on mental health and well-being was aggravated by a low average socioeconomic position of schools. Evidence concerning the role of school climate, school stratification (eg, performance base tracking) and sponsorship, food environment and sport facilities and equipment was generally weak or very weak and mostly based on singular findings. Overall, favourable meso-level characteristics mitigated the negative impact of low individual socioeconomic position on health outcomes.

Conclusions School characteristics affect health inequalities in children and adolescents to some degree, but future research is necessary to strengthen the existing evidence and address under-represented aspects in school characteristics and health outcomes.

INTRODUCTION

Rationale

Childhood and adolescence are periods in life that are usually characterised by good health, and in which future patterns of adult health are being established.^{1 2} Encouragingly, the health status of school-aged children and

Strengths and limitations of this study

- This scoping review follows the guidelines of the 'Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews'.
- This study is part of a series of scoping reviews of the German research group FOR2723, examining meso-level characteristics of the main socialising contexts of young people and their effect on health inequalities: family, kindergarten, school, vocational training, university and work as well as the impact of the healthcare system, from ages 0 to 25.
- Childhood and adolescence are crucial life stages due to the influence of health trajectories to adulthood.
- The wide scope of the objective and the expected heterogeneity of included studies only allow for a narrative synthesis of results instead of a meta-analysis.
- This scoping review only examines children and adolescents from developed economies and focuses on students' socioeconomic position as a cause of health inequalities.

adolescents in Germany and many other European countries has improved over the last decades.³ Despite this positive development, fundamental socioeconomic differences in students' health exist. Students in socioeconomically disadvantaged families have a reasonably higher chance of becoming ill or developing early risk factors for chronic non-communicable diseases in later life. For instance, children and adolescents from families with low socioeconomic position report poorer subjective health.⁴⁻⁷ In addition, higher prevalence of overweight, obesity,^{3 8} tobacco use⁹ and lower levels of physical activity have been found in this population.¹⁰ While these health inequalities are receiving renewed scientific interest, little is known about potential factors and

mechanisms that impact the relationship between socioeconomic position and health in young people.¹¹

Next to the family, the school represents a key institutional context for young people influencing their physical, psychological and social development.¹² Students spend the majority of their weekdays at school and with a group of classmates whom they interact with.^{13 14} In general, the school environment can be seen as a ‘multi-layered phenomenon’¹⁵ that consists of classrooms, schools and school tracks. These constitute the meso level between the micro level of the individual and the macro level of states or societies, each with their own characteristics, which impact each of the other levels. Thus, classrooms represent an important educational setting for young people and differ in terms of their meso-level characteristics, such as the learning environment, student participation and the relationships between teachers, students and classmates.^{13 16} In addition, particularly, primary schools are often described as comprehensive schools serving students from different socioeconomic positions and with different levels of ability, leading to a very heterogeneous composition of classrooms.

There has been a growing interest in unravelling the impact of this multilevel environment of schools on students’ health and academic outcomes (eg, academic self-concept and performance), taking into account characteristics of schools and classes.^{16–18} Accordingly, it is important to distinguish between compositional and contextual features of schools and classes to explain differences in student outcomes not only by individual-level but also by meso-level characteristics of the classes and schools.^{13 17} Compositional characteristics generally refer to the (social) composition of the student body within schools and classrooms. They are often assessed by aggregating individual student information, such as sociodemographic or school-related factors (eg, perception of the learning environment or class climate) at the meso level.^{19–21} Contextual characteristics of schools or classes include institutional features of different school types as well as organisational, structural, cultural and physical factors of schools and classes (eg, qualification of the teaching staff, written and unwritten school norms and values, class or school size, equipment, facilities or schooling hours). Based on this literature, it is generally assumed that these characteristics are associated with cognitive and non-cognitive outcomes above and beyond students’ individual cultural and social resources.^{13 16–21}

A wide range of single compositional and contextual meso-level school characteristics was investigated in previous studies. They can be broken down into five broader categories: school composition, school climate, policies, facilities and obesogenic environment.

School composition includes characteristics that result from aggregating individual-level characteristics across school classes or schools. These might include characteristics, such as the average socioeconomic

position or school achievements of students, gender ratios, ethnic composition, rates of school attendance or common health behaviours of students. The impact of social comparison and reference group effects²² have been well studied in educational and psychological sciences in relation to outcomes, such as self-esteem, academic self-concept and performance,^{15 22 23} but rarely with regard to health outcomes.¹⁸

School climate or school culture includes characteristics that describe the quality of the interactions within schools and the overall character of school life aggregated or measured at the meso level. These might relate to the teacher–student relationships, such as the way teachers control students and demand school achievements, how teachers promote autonomous learning and interactions between students, or students’ perception of teaching practices, in general. Relationships between students are relevant for health and well-being as well, which pertain to the relationships between students or student’s and school staff’s norms regarding life in school. A positive school climate is associated with higher school satisfaction and attachment, and such a school environment, in turn, promotes a healthy physical, psychological and social development.^{18 24 25}

School organisation and policies include the usually codified norms and expectations present in schools, which are often enforced by staff, and which relate to aspects, such as alcohol consumption or substance use. These have been studied extensively with regards to these health behaviours and are often targeted by school interventions.^{18 26–28}

School facilities and the physical school environment, in general, can have an impact on students’ health, well-being or health behaviour. The availability of, for example, a gymnasium, sports equipment on the school grounds or a swimming hall might provide opportunities for engaging in physical activity (ie, improved health behaviour), or the structural conditions of the school or its surroundings might impact students’ health as well.^{18 29}

An obesogenic environment includes all aspects of schools that reinforce unfavourable eating behaviours or low physical activity levels. This overlaps with aspects of other categories, such as policies (eg, guidelines for healthy school meals) or school facilities (eg, the availability and stocking of vending machines on school grounds). Though this might be included in other categories, it is listed separately due to the considerable attention it gained in previous research.^{30–36}

While associations between school characteristics and overall health are well studied, little is known about possible effects of meso-level factors on the strength and direction of health inequalities prevalent among young people. This is a research gap because it can be assumed that characteristics of schools are likely to shape socioeconomic inequalities in health among children and adolescents, above and beyond individual-level characteristics. Meso-level characteristics might either mediate

health inequalities, that is, the socioeconomic position might determine meso-level characteristics, which in turn influence health outcomes, or it might be moderated, that is, the association between socioeconomic position and health outcome change, depending on meso-level characteristics.

Several reviews already summarised studies on the direct impact of these meso-level characteristics on numerous students' health outcomes, but not their mediating or moderating role regarding health inequalities. The outcomes mostly focused on were alcohol consumption, smoking and substance use,^{18 26–28 37} eating behaviour and obesity,^{32 33 35 38 39} behavioural and conduct problems^{18 28 40} or physical activity and sedentary behaviours.^{30 31 34 36 38}

The evidence on the association between meso-level characteristics of classes or schools and students' health, well-being and health behaviours suggests that the average impact is low to moderate (eg, the impact of tobacco control policies on smoking, the association of high school attendance rates with lower rates of substance use, the relationship between a good school climate and better subjective well-being).^{18 26 27} Some studies consider individual characteristics to mediate the effects of meso-level characteristics^{18 27 31 34} or to act as a moderator.³⁶

The examination of the wider social determinants of health^{41 42} is necessary to extend the predominant focus on factors at the individual level as drivers of health inequalities. According to existing approaches linking more proximal macro-level determinants (eg, welfare state regimes) to health and health inequalities,^{43 44} it is conceivable that meso-level characteristics (eg, school composition, school climate, policies, facilities or obesogenic environment) may have a direct effect on health and possibly mediating or moderating the association between students' socioeconomic position and health, health behaviour and well-being.^{45 46} This expanded focus could contribute to a more comprehensive understanding of the drivers behind socioeconomic inequalities in students' health outcomes.

The aim of this scoping review was to answer the following research question: Is the association between socioeconomic position and students' health mediated or moderated by compositional or contextual characteristics of schools? This study is part of a series of scoping reviews of the German research group FOR2723, examining meso-level characteristics of the main socialising contexts of young people and their effect on health inequalities. Other reviews cover the impact of characteristics of the family,⁴⁷ of kindergartens⁴⁸ or of the workplace or university after leaving school⁴⁹ on health inequalities.

Objectives

The objective was to retrieve and synthesise evidence about the mediating or moderating role of compositional or contextual characteristics of schools for the association between students' socioeconomic position and health.

METHODS AND ANALYSIS

The scoping review followed an extension to the original PRISMA statement 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses',⁵⁰ the PRISMA extension for scoping reviews (PRISMA-ScR).⁵¹ Scoping reviews are conducted to comprehensively assess the existing literature on a complex situation and/or problem. Following the PRISMA-ScR, we did not critically appraise the quality and risk of bias of the included studies or conduct a meta-analysis.

Protocol and registration

The protocol for this scoping review was published in December 2020.⁵²

Eligibility criteria

We included all publications in the scoping review that fulfilled the criteria regarding study design, population, determinants, outcomes, language and publication date, shown in [table 1](#).

Information sources

We searched the following electronic databases:

- ▶ PubMed/Medline.
- ▶ Web of Science.
- ▶ Education Resources Information Center.

This selection of databases covers health, medical, educational and social sciences. We also searched the references of publications that met the inclusion criteria for further eligible sources of evidence. Grey literature was not included.

Search

We conducted the electronic searches using four blocks of search terms as well as an additional restriction by date. The summary of the electronic search strategy was as follows:

- ▶ Block 1: schools.
- ▶ Block 2: context/meso-level characteristics.
- ▶ Block 3: outcomes.
- ▶ Block 4: socioeconomic position.
- ▶ Other: date.

A full overview of all search terms for each block is given in online supplemental appendix 1. The search terms within each block were linked with the OR logical operator, and the blocks were linked with the AND operator. We searched titles and, if these were inconclusive, abstracts were screened as well. For PubMed/Medline, some of the search terms were also marked as MeSH-Terms ('Medical Subject Headings').³⁹ The full syntax used for the electronic search in PubMed/Medline is found in online supplemental appendix 2.

Selection of sources of evidence

All search results were combined and then automatically deduplicated using a reference management software (Citavi V.6).⁵³ Two reviewers screened titles and abstracts independently (MH and MHa). Disagreements were resolved by discussion between both reviewers. Two

Table 1 Overview of inclusion and exclusion criteria

| | | |
|--------------------------|-----------|---|
| Study designs | Included: | <ul style="list-style-type: none"> ▶ Cross-sectional studies ▶ Intervention studies (baseline data only) ▶ Cohort studies ▶ Longitudinal studies ▶ Case-control studies ▶ Qualitative studies |
| | Excluded: | <ul style="list-style-type: none"> ▶ Case studies ▶ Author replies/comments ▶ Animal studies ▶ Cell studies ▶ Reviews |
| Population | Included: | <ul style="list-style-type: none"> ▶ Students attending schools for primary or secondary education (ISCED Levels I, II and III, 'International Standard Classification of Education')⁹⁰ ▶ Studies conducted in developed economies (United Nations Classification)⁹¹ |
| | Excluded: | <ul style="list-style-type: none"> ▶ Students attending special schools |
| Determinants of interest | Included: | <ul style="list-style-type: none"> ▶ A study must report at least one determinant, which is a contextual or compositional characteristic of school, as well as at least one indicator of students' socioeconomic position. Furthermore, the study must examine the associations of the determinants with health outcomes, as well as associations between individual-level and meso-level determinants, in order to assess the mediating or moderating role of meso-level characteristics. ▶ Compositional characteristics of schools or classes, for example, School socioeconomic position, migrant status ratios, age ratios, gender ratios, or competencies of students in the school or class ▶ Contextual characteristics of schools or classes, for example, School type, school funding, school or class size, school hours, school profile, school staff, school location, school facilities, school equipment ▶ Socioeconomic position at the individual level, for example, School type, socioeconomic position, parental education, parental income, parental occupational position |
| | Excluded: | <ul style="list-style-type: none"> ▶ Studies that do not examine the association between compositional or contextual characteristics of schools regarding the explanation of health inequalities |
| Outcomes | Included: | <ul style="list-style-type: none"> ▶ Health and health-related outcomes, for example, Subjective health, subjective well-being, indicators of objective health (eg, diagnosed diabetes type I, biomarkers) ▶ Health behaviour and related outcomes, for example, Nutrition/diet, physical activity/inactivity (eg, sedentary behaviour), smoking, alcohol consumption, teeth brushing, media consumption |
| Languages | Included: | <ul style="list-style-type: none"> ▶ German ▶ English |
| Publication date | Included: | <ul style="list-style-type: none"> ▶ Studies published since 1 January 2000 |

ISCED, International Standard Classification of Education.

reviewers (MHe and MHa) then screened full texts of the remaining publications independently. Disagreements were discussed and resolved by a third researcher (IM), in case, no agreement could be achieved between both reviewers.

Data charting process

Two authors (MHe and MHa) independently extracted the data from all included studies using a previously developed data extraction form. One author (IM) compared and reviewed the extracted data.

Data items

The data were extracted, using a data extraction form, which was developed by one author (MHe) and tested using a convenience sample of known relevant studies from preliminary searches by three (MHe, MHa and IM). Extracted information included the following data:

- ▶ Author names.
- ▶ Year of publication.
- ▶ Year that study was conducted.
- ▶ Country of sample origin.
- ▶ Study design.

- ▶ Number of participants.
- ▶ Sociodemographic characteristics of participants
- ▶ Socioeconomic position of participants.
- ▶ Compositional and contextual characteristics of schools.
- ▶ Outcome measures.
- ▶ Analytic strategy.
- ▶ Short summary of main findings.

Critical appraisal of individual sources of evidence

Since a critical appraisal is not foreseen when conducting scoping reviews,⁵¹ we did not provide a critical appraisal of individual sources of evidence.

Synthesis of results

Due to the wide scope of the review and the heterogeneity in methods, outcomes and determinants in the included publications, we conducted a narrative synthesis of findings following the guidance of the Centre for Reviews and Dissemination.⁵⁴ For the narrative synthesis, we first examined whether meso-level characteristics of the included studies could be matched to the broad categorisations (ie, school composition, school climate, school organisation and policies, obesogenic environment and school facilities) we had previously developed based on our preliminary research. As expected, the included studies were very heterogeneous in terms of the meso-level characteristics included, which were examined as mediators or moderators of health inequalities. These characteristics were ultimately used to explore relationships within and across studies and to compare findings across studies. We discussed whether grouping the included studies according to the existing category system would be useful, which categories to assign them to, and whether additional categories might need to be introduced or existing ones modified. Regarding population (students in developed economies), outcomes (different aspects of health) or other determinants (socioeconomic position), the studies were quite homogeneous by inclusion criteria, and groupings by other characteristics (eg, the country in which the study was conducted, a distinction between longitudinal and cross-sectional designs, analysis strategies) were also discussed but rejected. When presenting the individual results of each study, the results were first summarised according to these groupings. In the subsequent synthesis, a broader overview of the results was developed, including the populations considered, the analytic strategies used and the underlying theoretical frameworks that the publications were based on. The narrative synthesis was supplemented by further approaches to summarise the studies and visualise their key findings, that is, a tabulated summary provided an overview of the studies' characteristics and harvest plots helped visualise the results.⁵⁵

Patient and public involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and not consulted to develop patient-relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

RESULTS

Selection of sources of evidence

The electronic search from 18 November 2020 yielded a total of 8322 sources after deduplication. After the first screening, we discarded 8098 sources. We obtained full texts for 224 sources for further assessment. A total of 198 sources did not meet the inclusion criteria and were discarded. Most of these sources either did not include any or suitable measures of socioeconomic position (eg, neighbourhood or migration background as proxies for socioeconomic position) in their analyses or did not test for the moderation or mediation of health inequalities. Fewer sources were excluded because they were missing relevant health outcomes (eg, aggregated health outcomes), were intervention studies that did not include relevant data at baseline, did not include relevant meso-level characteristics in their analyses (eg, focused on kindergartens) or because of other reasons (eg, used data from economies in transition or developing economies, were only study protocols, were in different languages). We included 26 research papers in the scoping review. The selection process is presented in figure 1.

Characteristics of sources of evidence

Twenty-six studies met the inclusion criteria.^{45 56–81} Two studies analysed international data from either 33 developed countries or six European countries, respectively.^{45 68} Ten studies covered the USA,^{58 61 62 65 70 71 73 75 77 81} five the UK,^{57 59 72 76 80} two the Netherlands,^{56 66 67} two Finland,^{78 79} and one each Australia,⁶⁹ France,⁶⁰ Germany,⁶³ Norway⁶⁴ and Sweden.⁷⁴ The sample sizes differed widely, ranging from 184 160 in the largest international study, and approximately 184 000 students in the largest national study, down to 108 in the smallest quantitative one, and 36 in the single included qualitative study. Four studies implemented a longitudinal design^{57 58 61 77} and 22 were cross-sectional.^{45 59 60 62–76 78–81} Only one of the studies analysed data from a qualitative survey,⁸⁰ all others analysed quantitative data. An overview of the study characteristics is given in table 2. Further characteristics which were summarised include the year the data were collected, more detailed information on the location of the study, where available, the age and grade levels of the included students as well as the number of schools examined in each study.

Results of individual sources of evidence

School composition

Four studies (Goodman *et al*,⁶² Martin *et al*,⁷¹ Moore *et al*⁷² and Shackleton *et al*⁷⁶) examined the average

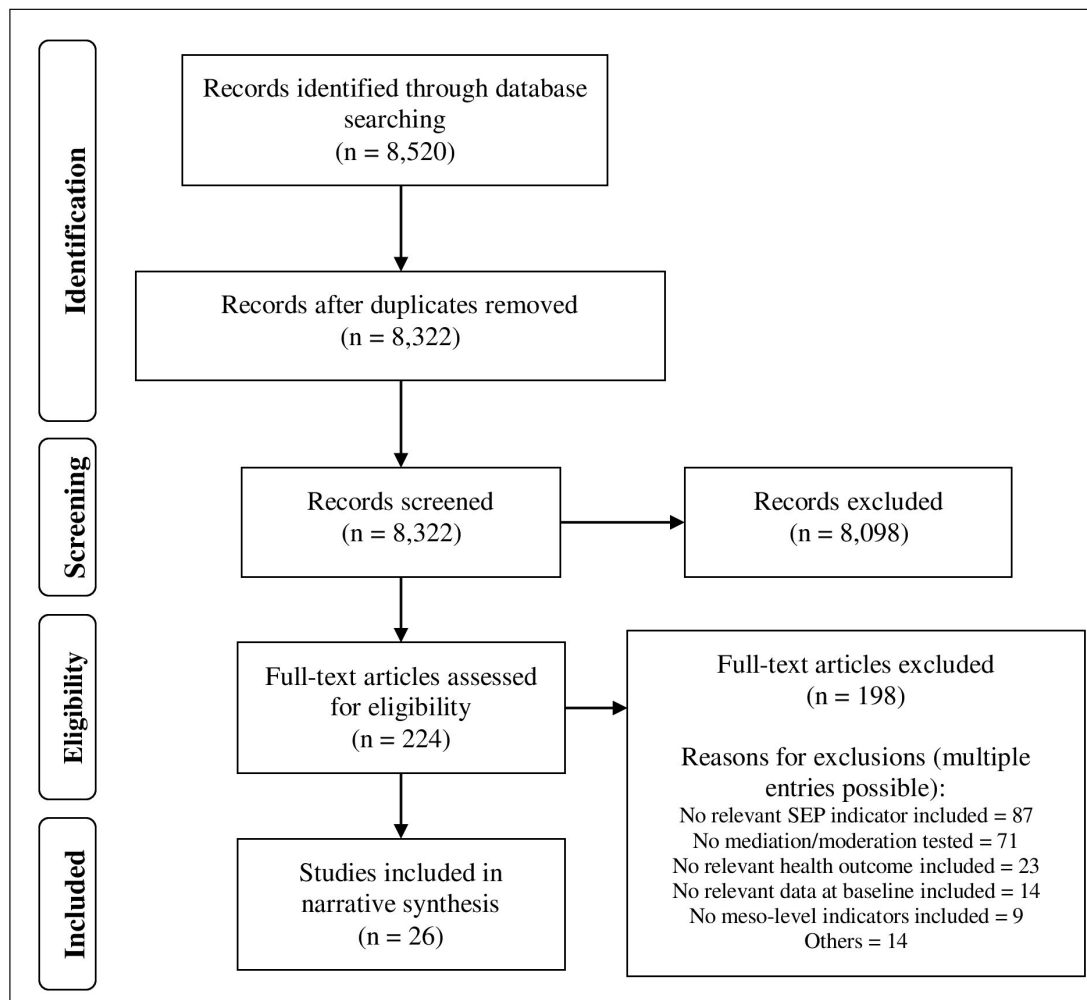


Figure 1 PRISMA flow diagram. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analysis; SEP, socioeconomic position.

socioeconomic position of schools as a moderator of health inequalities for adolescents. In all four, a low socioeconomic position of the school aggravated the negative impact of a low individual socioeconomic position on students' health outcomes, that is, depressive symptoms, BMI (Body Mass Index), life satisfaction and risky health behaviours, well-being and quality of life. Furthermore, Shackleton *et al*⁷⁶ reported a negative impact of a higher discordance between individual and school-level socioeconomic position on antisocial behaviour. However, Moore *et al*⁷² also tested six other outcomes (ie, physical activity, eating habits, smoking, alcohol consumption, substance use, self-rated health and life satisfaction) and found no moderation.

Three studies (Huisman and Bruggeman,⁶⁶ Olsson and Fritzell⁷⁴ and Lewis *et al*⁶⁹) examined characteristics of school composition as mediators for health inequalities. Huisman and Bruggeman⁶⁶ found that a high percentage of smokers among friends mediated the negative impact of a low school type (ie, schools that did not provide academic preparatory education) on adolescents' smoking, though in this case, school type was used as a proxy for students' socioeconomic position. Olsson and

Fritzell⁷⁴ and Lewis *et al*⁶⁹ also examined schools' average socioeconomic position and Olsson and Fritzell⁷⁴ also the proportion of students with migration background but found no mediation of inequalities in health behaviour.

School climate

Five studies (Bonell *et al*,⁵⁷ Grüttner,⁶³ Piccolo *et al*,⁷⁵ Virtanen *et al*,⁷⁸ and Youngblade *et al*⁸¹) examined a wide variety of meso-level characteristics with regards to school climate (eg, engaging school environment, student commitment, psychosocial climate among teachers, school violence) and their role for health inequalities of students in secondary education. Bonell *et al*⁵⁷ reported that a positive student commitment in school mitigated the negative impact of low family affluence on smoking, though only for non-white students and not for other school climate indicators (ie, engaging school environment, staff relationships with students, integration of students' academic education and broader social development or school-community relationships) and other outcomes (ie, alcohol consumption and substance use). Piccolo *et al*⁷⁵ found that better support in school mitigated the negative impact of low family income on

Table 2 Overview of included studies (26 sources)

| Study | Year | Location | Design | Students | Age | Classes | Schools |
|--|-----------|-------------------------|-------------------------------|--------------|----------------------------|---------------------------|---------|
| Bonell <i>et al</i> ⁵⁷ | 2014–2017 | UK (England) | Longitudinal | 3337 | Range: 11–12 | – | 20 |
| Demment <i>et al</i> ⁵⁸ | 2011 | USA (New York) | Longitudinal | 281 | – | – | 17 |
| Desousa <i>et al</i> ⁵⁹ | 2004 | UK (Wales) | Cross-sectional | 3882 | Mean: 14.0 | – | 46 |
| Dubuisson <i>et al</i> ⁶⁰ | 2005–2007 | France | Cross-sectional | 1413 | Mean: 10.4 Range: 3–17 | – | – |
| Fernandes and Sturm ⁶¹ | 1999–2004 | USA | Longitudinal | 8392 | – | 5th grade | 1387 |
| Goodman <i>et al</i> ⁶² | 1995 | USA | Cross-sectional | 13 235 | Mean: 15.9 | 7th–12th grade | 132 |
| Grüttner ⁶³ | 2012 | Germany | Cross-sectional | 2146 | Range: 12–13 | 7th grade | – |
| Haug <i>et al</i> ⁶⁴ | 2005–2006 | Norway | Cross-sectional | 1347 | Mean: 13.0 | – | 68 |
| Högberg <i>et al</i> ⁴⁵ | 2009–2010 | 33 developed countries | Cross-sectional | 184 160 | – | 5th, 7th and 9th grades | – |
| Hood <i>et al</i> ⁶⁵ | 2008–2012 | USA | Cross-sectional | – (~184,000) | – | 8th, 10th and 12th grades | 1773 |
| Huisman and Bruggeman ⁶⁶ | 2008–2009 | Netherlands | Cross-sectional | 961 | Range: 13–14 | – | 5 |
| Huisman <i>et al</i> ⁶⁷ | 2007 | Netherlands | Cross-sectional | 3984 | Range: 12–16 | – | 147 |
| Kuipers <i>et al</i> ⁶⁸ | 2013 | Six European countries | Cross-sectional | 10 325 | Range: 14–17 | – | 50 |
| Lewis <i>et al</i> ⁶⁹ | 2011–2012 | Australia (Adelaide) | Cross-sectional | 528 | Mean: 10.8 Range: 9–11 | – | 26 |
| Li and Hooker ⁷⁰ | 2003–2004 | USA | Cross-sectional | 62 880 | Range: 6–17 | – | – |
| Martin <i>et al</i> ⁷¹ | 1994–1995 | USA | Cross-sectional | 16 133 | Mean: 15.4 | 7th–12th grade | 132 |
| Moore <i>et al</i> ⁷² | 2013–2014 | UK (Wales) | Cross-sectional | 9055 | Range: 11–16 | – | 82 |
| O'Hara and Haynes-Maslow ⁷³ | 2004–2007 | USA | Cross-sectional | 2263 | – | 5th–8th grade | – |
| Olsson and Fritzell ⁷⁴ | 2010 | Sweden (Stockholm) | Cross-sectional | 5484 | – | 9th grade | 93 |
| Piccolo <i>et al</i> ⁷⁵ | 2009–2012 | USA | Cross-sectional | 108 | Range: 9–18 | – | – |
| Shackleton <i>et al</i> ⁷⁶ | 2014–2017 | UK (South-east England) | Cross-sectional | 6000 | Range: 11–12 | 7th grade | 40 |
| van Hook and Altman ⁷⁷ | 1999–2007 | USA | Longitudinal | 19 450 | Mean: 11.2 | – | 1000 |
| Virtanen <i>et al</i> ⁷⁹ | 2004–2005 | Finland | Cross-sectional | 136 | Mean: 15.6 | – | 136 |
| Virtanen <i>et al</i> ⁷⁸ | 2008–2009 | Finland | Cross-sectional | 23 182 | Mean: 15.4 | 8th–9th grade | 181 |
| Wills <i>et al</i> ⁸⁰ | 2003–2004 | UK (Scotland) | Cross-sectional (qualitative) | 36 | Range: 13–14 | – | 3 |
| Youngblade <i>et al</i> ⁸¹ | 2003 | USA | Cross-sectional | 42 305 | Mean: 13.9 Range: 11–17 | – | – |

students' cortical thickness, though not for executive function (measured via tasks from the National Institute of Health Toolbox Cognition Battery).⁸² The other studies found no impact of school climate indicators on health inequalities as either mediators or moderators.

School organisation and policies

Six studies (Desousa *et al.*,⁵⁹ Högberg *et al.*,⁴⁵ Huisman *et al.*,⁶⁷ Kuipers *et al.*,⁶⁸ Lewis *et al.*⁶⁹ and Li and Hooker)⁷⁰ examined some aspects of policy or organisation with regards to schools and their impact on health inequalities among adolescents or in case of Li and Hooker⁷⁰ also for children from 6 years. Högberg *et al.*⁴⁵ conducted an international comparison and reported that higher school stratification (measured via a modified version of the index of between-school horizontal stratification by the OECD (Organisation for Economic Co-operation and Development)⁸³ mitigated the negative impact of low family affluence on students psychological and psychosomatic health complaints. Li and Hooker⁷⁰ reported that public sponsorship of schools—in contrast to private sponsorship—aggravated the negative impact of household poverty on BMI. Finally, Huisman *et al.*⁶⁷ found that a low school type (ie, schools that did not provide academic preparatory education) mediated the negative impact of lower parental education on adolescents' smoking. Neither Desousa *et al.*⁵⁹ examining school alcohol policies nor Kuipers *et al.*⁶⁸ examining several indicators regarding school smoking policies found any moderation for health inequalities in alcohol consumption or smoking, respectively. Lewis *et al.* found no mediation of inequalities in physical behaviour by school policies.

Obesogenic environment

Three studies (O'Hara and Haynes-Maslow,⁷³ Virtanen *et al.*⁷⁸ and van Hook and Altman)⁷⁷ examined the moderating impact of fast food availability in schools through several indicators (ie, vending machines on school premises, distance to fast food restaurants from school, competitive food sales) on adolescents' health inequalities. However, only Virtanen *et al.*⁷⁸ found that higher fast food availability aggravated the negative impact of parental education on eating habits. O'Hara found no impact regarding inequalities in eating habits, physical activity, sedentary behaviour or BMI and van Hook and Altman⁷⁷ found not effect inequalities in the change of BMI from fifth to eighth grade.

Three studies (Demment *et al.*,⁵⁸ Wills *et al.*⁸⁰ and Dubuisson *et al.*)⁶⁰ examined other aspects of the obesogenic environment. Demment *et al.*⁵⁸ found that a better nutrition and physical activity environment of schools' increased the positive impact of high household income on BMI, though not the negative impact of low household income. Wills *et al.*⁸⁰—the only qualitative study included in this review—reported that better eating habits of peers might mitigate the negative impact of low family socioeconomic position on adolescents eating habits. Finally, Dubuisson *et al.*⁶⁰ examined the impact of school

canteen attendance on inequalities in eating habits and sedentary behaviour in children as well as adolescents but found no moderation.

School facilities

Four studies (Fernandes and Sturm,⁶¹ Lewis *et al.*,⁶⁹ Haug *et al.*⁶⁴ and Hood *et al.*)⁶⁵ examined the impact of the availability and/or quality of sports facilities and equipment on school premises on adolescent health inequalities regarding physical activity or BMI. Fernandes and Sturm⁶¹ reported better sports facilities to mediate the association between household income and physical activity, though not for BMI. Also, Hood *et al.*⁶⁵ reported that they moderated this association with BMI, that is, mitigating the negative impact of low parental education on BMI. However, Lewis *et al.*⁶⁹ found no mediation and Haug *et al.*⁶⁴ found no moderation regarding physical activity.

Synthesis of results

The findings were mostly mixed, as of the 26 included studies, only 12 studies found a moderating and three a mediating effect of meso-level characteristics on students' health inequalities. The evidence for the moderation of health inequalities by the average socioeconomic position of the school is the strongest, as these findings were replicated over several studies. Four studies reported that a low average socioeconomic position of the school aggravated the negative impact of a low individual socioeconomic position on adolescents' health. Almost all other evidence is based on singular findings without directly comparable studies, with the exception of fast food availability, which was found to have almost no moderating impact on health inequalities. A full overview is presented in [table 3](#).

The focus of the studies was clearly on the moderating effects of meso-level characteristics on student health inequalities. On the one hand, unfavourable meso-level characteristics were shown to reinforce health inequalities, for example, the low average socioeconomic position of students within a school or high fast food availability put a double burden on students with low individual socioeconomic position. On the other hand, favourable meso-level characteristics have the potential to decrease health inequalities, for example, better sports facilities and equipment or better academic support in school can improve health equity. Thus, changes and interventions at the level of school contexts have the potential to have at least a slight impact on health inequalities and to reduce them.

In case of mediations, students' lower socioeconomic position was associated with unfavourable meso-level characteristics, which in turn were associated with worse health outcomes (eg, through a higher percentage of smokers among friends, or through worse availability of sports facilities and equipment).

Regarding population, the included studies almost exclusively focused on students in secondary education. Only Dubuisson *et al.*⁶⁰ and Li and Hooker⁷⁰ included

Table 3 Summary of evidence (26 sources)

| Individual-level SEP indicators | | School-level determinants | Outcomes | Results |
|---|---------------------------------------|--|---|---|
| Focus | Study | | | |
| School composition | Goodman <i>et al</i> ⁶² | Household income | <i>Mental health</i> depressive symptoms (Center for Epidemiologic Studies-Depression Scale, CES-D) | <i>Moderation</i> low SEP of school aggravates the negative impact of low household income on depressive symptoms |
| School composition | Huisman and Bruggeman ⁶⁶ | Parental education school type | <i>Health behaviour</i> smoking | <i>Mediation</i> high percentage of smokers among friends mediates negative impact of low school type on smoking |
| School composition | Martin <i>et al</i> ⁷¹ | Parental education | <i>Physical health</i> BMI | <i>Moderation</i> low SEP of school aggravates negative impact of low parental education on BMI |
| School composition | Moore <i>et al</i> ⁷² | Family affluence (Family Affluence Scale, FAS) | <i>Physical health, well-being, health behaviour</i> physical activity eating habits (daily fruit and vegetable consumption) smoking alcohol consumption substance use self-rated health life satisfaction | <i>Moderation</i> low SEP of school aggravates negative impact of low family affluence on life satisfaction |
| School composition | Olsson and Fritzell ⁷⁴ | Parental education | <i>Health behaviour</i> alcohol consumption substance use | <i>No mediation</i> |
| School composition | Shackleton <i>et al</i> ⁷⁶ | Family affluence (Family Affluence Scale, FAS) | <i>Well-being, mental health, health behaviour</i> risk behaviour (smoking and alcohol consumption) anti-social behaviour (Edinburgh Study of Youth Transitions and Crime—school misbehaviour subscale, ESYTC) well-being quality of life | <i>Moderation</i> low SEP of school aggravates negative impact of low family affluence on risk behaviour, well-being, and quality of life high discordance between SEP of school and family affluence has negative impact on anti-social behaviour |
| School composition, school organisation and policies, school facilities | Lewis <i>et al</i> ⁶⁹ | Household income | <i>Health behaviour</i> physical activity (moderate to vigorous physical activity, MVPA) | <i>No mediation</i> |

Continued

Table 3 Continued

| Focus | Study | Individual-level SEP indicators | School-level determinants | Outcomes | Results |
|----------------------------------|---------------------------------------|--|---|--|--|
| School climate | Bonell <i>et al</i> ⁶⁷ | Household worklessness family affluence (Family Affluence Scale, FAS) | <i>Moderators:</i> engaging school environment ('value-added education', VAE) school boundaries (staff reports on organisational school climate) student commitment (subscale of the Beyond Blue School Climate Questionnaire) student belonging (subscale of the Beyond Blue School Climate Questionnaire) | <i>Health behaviour</i> smoking (at 36 month follow-up) alcohol consumption (at 36 month follow-up) substance use (at 36 month follow-up) | <i>Moderation</i> better student commitment mitigates negative impact of low family affluence on smoking for non-White students |
| School climate | Grüttne ⁶³ | Parental education literature at home | <i>Mediators:</i> learning environment (achievement oriented class climate) | <i>Health behaviour</i> eating habits (screening for eating disorder, SCOFF) | <i>No mediation</i> |
| School climate | Piccolo <i>et al</i> ⁷⁵ | Family income parental education | <i>Moderators:</i> school climate (academic support in school) | <i>Physical health</i> executive function cortical thickness | <i>Moderation</i> better school climate mitigates negative impact of low family income on executive function |
| School climate | Virtanen <i>et al</i> ⁷⁹ | Parental education | <i>Mediators:</i> psychosocial climate among teachers (14-item version of The Team Climate Inventory+pupil survey) school-SES (proportion of low-SES students in school) | <i>Mental health</i> psychosomatic symptoms, self-reported depression (12-item Beck Depression inventory) | <i>No mediation</i> |
| School climate | Youngblade <i>et al</i> ⁶¹ | Parental education household income | <i>Moderators:</i> school safety school violence | <i>Physical health, health behaviour, mental health</i> sleeping behaviour physical activity BMI internalising and externalising behaviour | <i>No moderation</i> |
| School organisation and policies | Högberg <i>et al</i> ⁴⁵ | Family affluence (Family Affluence Scale, FAS) | <i>Moderators:</i> school stratification (by country) | <i>Mental health</i> psychological and somatic health complaints (HBSC Symptoms Checklist) | <i>Moderation</i> high school stratification mitigates negative impact of low family affluence on psychological and somatic health complaints |
| School organisation and policies | Desousa <i>et al</i> ⁶⁹ | Family affluence (Family Affluence Scale, FAS) | <i>Moderators:</i> school alcohol policy (school policy on alcohol, informal or written) | <i>Health behaviour</i> alcohol consumption (likelihood of binge drinking) | <i>No moderation</i> |
| School organisation and policies | Huisman <i>et al</i> ⁶⁷ | Parental education | <i>Mediators:</i> school type (preparatory academic education, preparatory vocational education, and general intermediate education) | <i>Health behaviour</i> smoking | <i>Mediation</i> low school type mediates negative impact of lower parental education on smoking |
| School organisation and policies | Kuipers <i>et al</i> ⁶⁸ | Parental education | <i>Moderators:</i> student perceived smoking policy (staff reported smoking policy (three subscales regulations, communication and sanctions) school smoking prevalence) | <i>Health behaviour</i> smoking | <i>No moderation</i> |

Continued

Table 3 Continued

| Focus | Study | Individual-level SEP indicators | School-level determinants | Outcomes | Results |
|----------------------------------|--|---|---|---|--|
| School organisation and policies | Li and Hooker ⁷⁰ | Parental education household poverty level | <i>Moderators:</i> sponsorship (public or private school) | Physical health BMI | <i>Moderation</i> public sponsorship aggravates negative impact of high household poverty level on BMI |
| Obesogenic environment | Demment <i>et al</i> ⁶⁸ | Household income (trajectories of family's movement in and out of low-income) | <i>Moderators:</i> nutrition and physical activity environment (N&PA environment assessment tool) | Physical health BMI | <i>Moderation</i> better nutrition and physical activity environment aggravate the positive impact of high household income on BMI, but do not mitigate the negative impact of low parental education on BMI |
| Obesogenic environment | Dubuisson <i>et al</i> ⁶⁰ | Household income parental occupation employment status parental education | <i>Moderators:</i> school canteen attendance | Health behaviour eating habits sedentary behaviour | <i>No moderation</i> |
| Obesogenic environment | O'Hara and Haynes-Maslow ⁷³ | Household poverty | <i>Moderators:</i> fast food availability (vending machine availability on school premises) | Physical health, health behaviour eating habits physical activity sedentary behaviour BMI | <i>No moderation</i> |
| Obesogenic environment | Virtanen <i>et al</i> ⁷⁸ | Parental education pocket money after-school employment | <i>Moderators:</i> fast food availability (distance from school to nearest fast-food outlet or grocery store) | Physical health, health behaviour BMI physical activity eating habits | <i>Moderation</i> high fast food availability aggravates negative impact of low parental education on eating habits |
| Obesogenic environment | Wills <i>et al</i> ⁸⁰ | Individual-level SEP (not reported, qualitative study) | <i>Moderators:</i> eating habits of peers | Health behaviour eating habits | <i>Moderation</i> better eating habits of peers mitigate the negative impact of low individual-level SEP on eating habits |
| Obesogenic environment | van Hook and Altman ⁷⁷ | Family SEP (ECLS-K instrument) | <i>Moderators:</i> fast food availability (competitive food sales at school) | Physical health BMI (change from fifth to eighth grade) | <i>No moderation</i> |
| School facilities | Fernandes and Sturm ⁶¹ | Household income | <i>Mediators:</i> sports facilities and equipment (eg, availability of gymnasium or playground and adequacy thereof) | Physical health, health behaviour physical activity (minutes of physical education and recess) BMI (trajectory) | <i>Mediation</i> better sports facilities and equipment mediate negative impact of low household income on physical activity |
| School facilities | Haug <i>et al</i> ⁶⁴ | Family affluence (Family Affluence Scale, FAS) | <i>Moderators:</i> sports facilities and equipment (16 items, for example, gymnasium, sport hall, soccer field, playground equipment) | Health behaviour physical activity | <i>No moderation</i> |
| School facilities | Hood <i>et al</i> ⁶⁵ | Parental education | <i>Moderators:</i> sports facilities (eg, availability of gymnasium, indoor track, weight room, dance studio) | Physical health, health behaviour BMI physical activity | <i>Moderation</i> better sports facilities and equipment mitigate negative impact of low parental education on BMI |

BMI, body mass index; SEP, socioeconomic position.

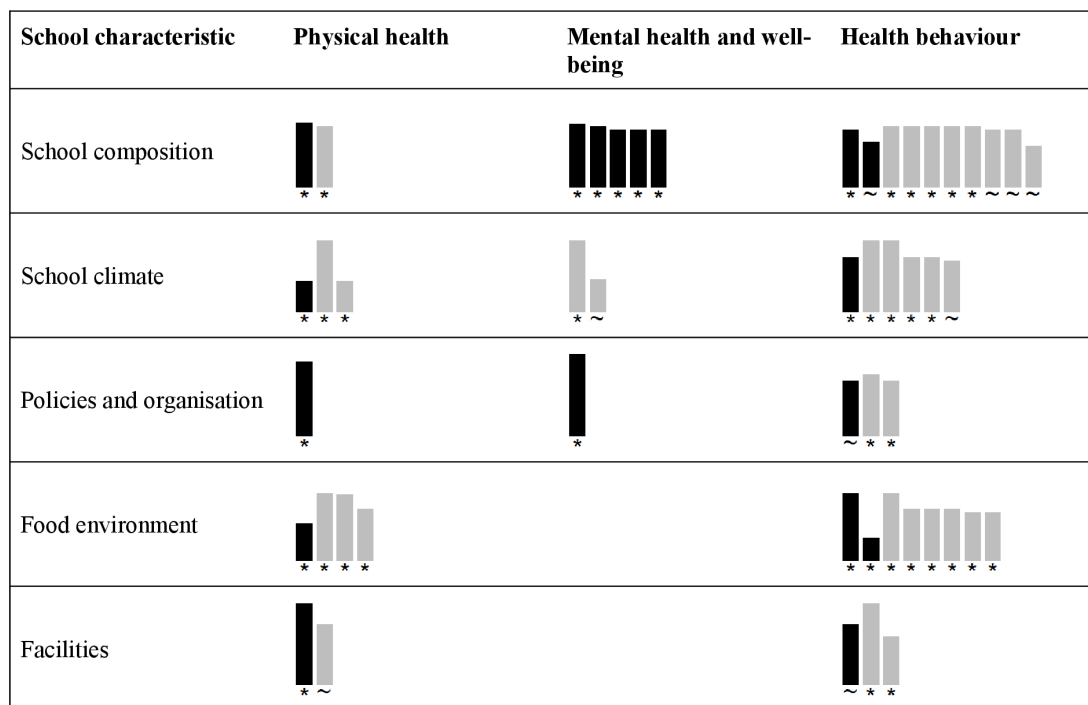


Figure 2 Harvest plot of findings for each analysed outcome, grouped by school characteristics and health outcomes. Notes: The height of the bars corresponds to the study's sample sizes on a logarithmic scale. ~ = Mediation. * = Moderation. Black bar = mediation or moderation found. Grey bar = no mediation or moderation found.

children in primary education, and only the latter found a moderating effect of school organisation in the form of public or private sponsorship. The analytical strategies were mostly deemed adequate. Fourteen studies, including all studies examining school composition, employed some sort of mixed models, using random effects to account for the nesting of students within schools and in case of analyses of moderations, the inclusion of some cross-level interaction terms. Eleven studies relied on other regression models without random effects, using interactions or split samples to examine moderations, or nested models to examine mediations. One study employed an exploratory qualitative design, interviewing students using semistructured interviews.

An overview of the findings of each analysed outcome is presented as a harvest plot in figure 2. For this overview, the results were further grouped by outcomes and it shows that the majority of analyses did not provide evidence for a mediation or moderation of students' health inequalities by school characteristics.

DISCUSSION

Summary of evidence

This scoping review included 26 studies, involving students from developed economies. The studies examined a wide variety of school characteristics as mediators or moderators of health inequalities. All school characteristics could be incorporated in our preliminary framework, which distinguished five broad categories: school

composition, school climate, school policies and organisation, food environment and facilities.

Studies examining school composition and more specifically the moderating effect of the average socioeconomic position of the school on adolescents' health inequalities were among the most rigorous regarding the analytical strategy, describing the methodology thoroughly, employing mixed models and testing cross-level interactions. They showed evidence for a small effect, that is, the negative impact of a low individual socioeconomic position being aggravated by a low average socioeconomic position of schools, mostly with regards to mental health and well-being. However, the transferability of results is limited because of the validity of some indicators used, depending on the country and school system examined (eg, the percentage of students eligible for free school lunch). This aspect of schools was covered by the great majority of the studies, but many other compositional characteristics were ignored altogether (eg, students' competencies or gender ratios).

Regarding all other categories, the included studies mostly provided weak or very weak evidence for a moderation or mediation of adolescents' health inequalities, as most findings were based on singular studies or could not be replicated over several studies (eg, findings regarding fast food availability in schools moderating inequalities in eating habits). For school climate, findings provided very weak evidence for a moderation of health inequalities, that is, a better school climate mitigating the negative impact of a low individual socioeconomic position

on health. However, these findings are strongly limited by the great heterogeneity of the used school climate measures as well as analytical strategies. For school policies and organisation, the findings showed an impact of some organisational features such as school stratification or sponsorship on health inequalities but not for health-related school policies. Higher school stratification and decreased and public sponsorship increased health inequalities, whereas school types mediated them. For food environment, the impact of higher availability of fast food was examined in four studies, but only one found it aggravating the negative impact of a low individual socioeconomic position for a singular outcome, eating habits. One study reported a reinforcement of the impact of a high individual socioeconomic position on BMI by a school environment, that supported healthy nutrition and physical activity, and the singular qualitative study reported positive eating habits of peers mitigating negative effects of a low individual socioeconomic position on adolescents' own eating habits. Finally, for facilities, the included studies exclusively examined the availability and quality of sports facilities, which were shown to mediate health inequalities in one study and to moderate it in another, that is, better availability mitigating the negative impact of a low individual socioeconomic position on BMI.

Most studies did not have a deeper theoretical underpinning and considered individual and meso-level characteristics solely as risk or protective factors. Only a few studies further explicated a theoretical model. For example, the theory of human functioning and school organisation,⁸⁴ reference group effects and the big-fish-little-pond effect,⁸⁵ or social network theories.⁸⁶ Adolescents spend an extremely large amount of time in school, and much of this in the classroom with peers who have the same developmental tasks to accomplish. The importance of contexts and social networks for human development has long been the subject of research,⁸⁷ but in the context of adolescent health research, it is only comparatively recently that research has gone beyond the importance of individual characteristics, increasingly including characteristics at the level of schools. School environment plays an essential role in shaping students' health and well-being. Mismatches between the social resources of the learning environment in classes and schools and students' developmental needs and abilities can negatively impact their overall life satisfaction or psychosomatic health, as the resources of the learning environment are instrumental in mastering developmental tasks.^{13 88} The relevance of the school context also results from the class as an interaction partner. The other adolescents, by virtue of the time spent together alone, are a central reference group with which adolescents compare themselves, for example, by placing the individual in relation to the contextual and compositional characteristics of the school class. From these comparisons, that is, from the interactions of individual characteristics with those of the school environment, their own effects on health and well-being

can emerge. School classrooms are places where adolescents must confront such reference group comparisons both in terms of their academic performance and in all other aspects of their physical, cognitive, emotional and social development.^{13 89}

Strengths and limitations

This scoping review is part of a series of other reviews by the German research group FOR 2723, whose various subprojects examine the most important contexts of young people and their significance for health or health inequalities, covering family,⁴⁷ kindergarten,⁴⁸ school and following contexts such as university or vocational training.⁴⁹ Together, these works form an overview of even greater scope than this review alone. Further benefits arise from the scoping review method itself. It is a tool for mapping broad subject areas. First, it could be used to identify clusters of research findings that represent trends in current research and could possibly be addressed in more focused reviews (eg, the studies on the influence of average socioeconomic position, which could possibly even be combined in a meta-analysis). On the other hand, unusual results or rare designs could also be considered (eg, the single qualitative study, or the study on the influence of school climate on cortical thickness or executive function). Furthermore, the methodology according to the guideline of the PRISMA-ScR⁵¹ is relatively strict and follows a transparent and rigorous process (eg, each search results and each study were screened by at least two authors for possible inclusion).

However, this work is also subjected to several limitations. This review is mostly exploratory in nature and provides an overview of current research but cannot provide in-depth analyses to answer more specific research questions. Therefore, several sources of bias for this scoping review must be emphasised. As there was no meta-analysis conducted, this review did not report effect sizes and only shortly summarised the main findings, providing only an overview of the field, not an assessment of the magnitude of the examined effects. Therefore, the used analytical strategies as well as the sample sizes of the included studies were not regarded in depth, and average effect sizes for the mediating or moderating role of school characteristics could not be determined, and the assessment of the quality of evidence is limited without a critical appraisal of the included studies. There was a distinct lack of comparability for most of the studies, and, therefore, most results of this review are based on singular findings. In addition to the differences between the meso-level characteristics studied and the indicators used, there are also differences by country that can affect the results. Furthermore, we did not examine children and adolescents from less developed economies or factors other than socioeconomic position as a cause of health inequalities. Finally, formal limitations made for enhancing the manageability of this scoping review might have introduced further bias, that is, the restriction to studies in English or German and to publications from

the year 2000 onwards as well as the exclusion of certain groups, such as children in special schools.

CONCLUSIONS

The objective was to retrieve and synthesise evidence about the mediating or moderating role of compositional or contextual characteristics of schools for the association between socioeconomic position and health children and adolescents attending primary or secondary education. We were able to identify a wide range of studies that addressed this issue, including several clusters of research activity, and summarise and synthesise results from some studies with moderate evidence, but for the most part only single studies with low evidence. A key finding was confirmed across multiple studies, namely, that the negative effects of a low socioeconomic position were exacerbated by a low average socioeconomic position of schools, especially in relation to students' mental health and well-being. In addition, other important findings on moderation effects were also found, either in the form that favourable meso-level characteristics (eg, good school climate, private sponsorship) moderated student health inequalities or that unfavourable meso-level characteristics (eg, easier availability of fast food) increased health inequalities. In general, few studies examined the mediating effect of meso-level characteristics on health inequalities, that is, that the impact of students' socioeconomic position on health was mediated by meso-level characteristics (ie, extent of performance-based school tracking, physical education facility equipment, percentage of smokers among friends in school). In sum, the findings from the scoping review underline that some meso-level school characteristics are associated with health inequalities in children and adolescents.

Further studies examining the mediating or moderating effects of school characteristics for health inequalities in children and adolescents are warranted to strengthen the existing evidence and address underrepresented aspects in school characteristics and health outcomes. Except for the role of one central characteristic of school composition (ie, the average socioeconomic position of the schools' students) as well as few aspects of school climate (eg, learning environment), food environment (eg, fast food availability) or facilities (ie, availability of sports facilities and equipment), only a small section of the research field has been covered so far. However, future studies need to address or avoid several limitations present in the current research. Regarding school characteristics, future studies need to extend their focus (eg, using other indicators than socioeconomic position such as gender ratio when examining school composition, or other facilities such as libraries when examining school facilities) or narrow their focus (eg, using more validated indicators for examining school climate). Regarding health outcomes, future studies need to put more emphasis on indicators of physical health as well as mental health and well-being indicators.

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